CALIFORNIA DEPARTMENT OF FOOD & AGRICULTURE

California Pest Rating Proposal for

Coleosporium plumeriae Pat. 1902

Plumeria rust

Current Pest Rating: C

Proposed Pest Rating: C

Domain: Eukaryota; Kingdom: Fungi
Phylum: Basidiomycota; Subphylum: Pucciniomycotina
Class: Pucciniomycetes; Order: Pucciniales
Family: Coleosporiaceae

Rust pustules on leaf of *Plumeria* sp. Photo: H. J. Scheck

Comment Period: 11/03/2020 through 12/18/2020

Initiating Event:

Plumeria rust caused by *Coleosporium plumeriae* was first detected in San Diego County on an incoming florist's shipment in 1999. At that time, it was known to be in the Caribbean, Central America,

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Florida, and Hawaii, but it was not known to be established in California. CDFA plant pathologist Timothy Tidwell assigned it a temporary Q rating. There have been occasional interceptions of *C. plumeriae* on incoming shipments from Hawaii, Florida, and South Carolina over last two decades. Between 2005 and 2015 it was found during regulatory nursery inspections and in residential landscapes in coastal San Diego County and, and it was given an informal C rating. In June 2020, it was detected during a regulatory nursery inspection in Orange County. The risk to California from *Coleosporium plumeriae* is described herein and a permanent rating is proposed.

History & Status:

Background: *Plumeria* species are small ornamental trees native to the West Indies. In the tropics around the world they are widely planted in parks and residential and commercial landscapes as specimen trees. In Hawaii, their large, fragrant, colorful flowers are used primarily in making lei and in floral arrangements. In California, they are grown outdoors in the mildest parts of the state along the coast from Santa Barbara to San Diego. They experience winter dormancy and can be damaged or killed by temperatures below 5^{o} C.

Plumeria rust was first recorded on the Caribbean island of Guadeloupe in 1902 and from there it spread to Central America and South America. It has been known from Florida since 1960 under the synonym *C. domingense* but was not reported elsewhere in the United States until it arrived in Hawaii in 1991. Subsequently, it has become widespread worldwide wherever *Plumeria* are grown including Oceana, Africa, and Asia. The presumption is that spread has occurred accidentally with trade in infected planting material and possibly due to El Niño and La Niña events in the Pacific Ocean (Kakishima et al. 2017).

Hosts: At least eight species and/or *forma sp*. of plumeria are hosts: *Plumeria alba*, *P. clusioides*, *P. rubra*, *P. obtusa, P. pudica, P. acuminata, P. acutifolia*, and *P. variegata* (the latter three are considered *forma* of *P. rubra*). *Catharanthus roseus* (Madagascar periwinkle) has been infected with artificial inoculation.

Symptoms: *Coleosporium plumeriae* is a microcyclic rust with no identified alternating host. Uredinia produce powdery, bright yellow or yellow orange urediniospores (stage II) on the undersides of leaves. In some environments, telia produce teliospores (stage III), generally at the end of the season on leaves that are already hosting large numbers of uredinia. Fragile, ephemeral basidia with basidiospores (stage IV) are produced from teliospores. All these spores can infect plumeria. Spermagonial (stage 0) and aecial stages (stage 1) are unknown.

Spots appear on the upper leaf surface that are first visible as small, yellowish flecks that can later coalesce and turn into brown, necrotic areas. The yellow spots correspond to developing lesions bearing spores on the abaxial or lower leaf surface. The undersides of infected leaves will develop numerous tiny, raised, yellow-orange, powdery rust pustules. The pustules may occur sparsely on the upper surface of heavily diseased leaves. As lesions age, they enlarge and coalesce, and the yellow

areas develop into sunken, angular, grayish to brown spots. Leaves can become severely diseased, covered with thousands of pustules. If this happens, they may dry, curl, become distorted, and fall. With repeating cycles of rust infection over time, defoliation can approach 100 percent on a plant. Stems and flowers are not infected (Nelson, 2009).

Infection of *Catheranthus roseus* has only been observed following artificial inoculation but it was described as very susceptible and showing typical symptoms. Other members of the dogbane family Apocynaceae were tested and found not be susceptible to infection (Holcomb and Aime, 2010).

Transmission: Most infections are caused by windborne urediniospores that are produced en masse and easily moved from the leaves by air current. The spores stick to moist leaves under wet or humid conditions. Spores germinate on leaves, penetrate the surface, and grow as fungal hyphae that infect plant cells. Uredinial sori erupt back through the epidermis and the spores are dispersed to new infection sites on the same or other leaves. A small fraction of infections are likely caused by the infrequent production of teliospores and basidiospores. The pathogen survives on infected leaves and leaf debris (Nelson, 2009).

Damage Potential: Rust pathogens rarely kill their hosts, and this one does not damage flowers. Repeating cycles of secondary infection can cause severe defoliation, which reduces flower production and weakens the trees (Oliveira et al., 2019). Varieties can range in their responses from highly susceptible, suffering rapid leaf colonization and abscission to highly resistant (Nelson, 2009).

Worldwide Distribution: American Samoa, Australia, Bermuda, Brazil, Canada, China, Colombia, Cuba, Dominican Republic, Guatemala, Guadeloupe, Guam, Guyana, India, Indonesia, Jamaica, Malaysia, Marshall Islands, Mexico, Micronesia, Nigeria, Panama, Peru, Taiwan, Thailand, Trinidad and Tobago, United States (California, Florida, Hawaii, Louisiana, Puerto Rico), Venezuela, Viet Nam, and Virgin Islands (Farr and Rossman, 2020: CABI-CPC, 2020; Yan et al. 2006; Wang et al. 2011; Yang et al. 2014).

Official Control: With a Q rating, detections on incoming shipments lead to shipments being rejected and returned to the shipper or destroyed. With an unofficial C rating, action is taken to ensure commercial cleanliness in licensed nurseries, where the disease is suppressed to a low level but does not need to be eradicated from nursery stock.

California Distribution: Regulatory nursery samples have been collected in Los Angeles and San Diego counties, which shows it is in the nursery trade. Residential samples have been received by the San Diego County Agricultural Commissioner's office (Patricia Nolan, pers. comm).

California Interceptions: Interceptions have been made in Contra Costa, Imperial, Orange, Santa Clara, San Diego, and Ventura counties, on incoming shipments from Hawaii, Florida, and South Carolina.

The risk *Coleosporium plumeriae* would pose to California is evaluated below.

Consequences of Introduction:

1) **Climate/Host Interaction:** Rusts are obligate pathogens that need a living host to survive and reproduce. *Plumeria* spp. are damaged by low temperatures and cannot survive winter outside in most of California. It is possible to raise them indoors or in greenhouses statewide.

   Evaluate if the pest would have suitable hosts and climate to establish in California.

   Score: **2**

   - Low (1) Not likely to establish in California; or likely to establish in very limited areas.
   - Medium (2) may be able to establish in a larger but limited part of California.
   - High (3) likely to establish a widespread distribution in California.

2) **Known Pest Host Range:** The host range of this rust pathogen is limited to plumeria and Madagascar periwinkle (by inoculation only).

   Evaluate the host range of the pest.

   Score: 1

   - Low (1) has a very limited host range.
   - Medium (2) has a moderate host range.
   - High (3) has a wide host range.

3) **Pest Reproductive Potential:** This pathogen reproduces asexually with massing numbers of autoinfecting urediniospores and disease can increase in severity exponentially. The spores are moved by wind or by the movement of infected leaves or plants.

   Evaluate the natural and artificial dispersal potential of the pest.

   Score: 2

   - Low (1) does not have high reproductive or dispersal potential.
   - Medium (2) has either high reproductive or dispersal potential.
   - High (3) has both high reproduction and dispersal potential.

4) **Economic Impact**: Plumeria are grown for their flowers, which are not directly affected by the rust. However, premature defoliation reduces tree vigor and flower yield.

   Evaluate the economic impact of the pest to California using the criteria below.

   Economic Impact: A

   A. The pest could lower crop yield.
   B. The pest could lower crop value (includes increasing crop production costs).
   C. The pest could trigger the loss of markets (includes quarantines).
   D. The pest could negatively change normal cultural practices.
   E. The pest can vector, or is vectored, by another pestiferous organism.
   F. The organism is injurious or poisonous to agriculturally important animals.
   G. The organism can interfere with the delivery or supply of water for agricultural uses.

   Economic Impact Score: **1**

- Low (1) causes 0 or 1 of these impacts.
- Medium (2) causes 2 of these impacts.
- High (3) causes 3 or more of these impacts.

5) **Environmental Impact:** Most rusts are highly host specific and this seems to be true for this species. Plumeria are not native or naturalized in California. Ornamental plantings can suffer losses in flower yield and resistant cultivars should be selected whenever possible.

Environmental Impact: E

A. The pest could have a significant environmental impact such as lowering biodiversity, disrupting natural communities, or changing ecosystem processes.
B. The pest could directly affect threatened or endangered species.
C. The pest could impact threatened or endangered species by disrupting critical habitats.
D. The pest could trigger additional official or private treatment programs.
E. The pest significantly impacts cultural practices, home/urban gardening or ornamental plantings.

Environmental Impact Score: 2
- Low (1) causes none of the above to occur.
- Medium (2) causes one of the above to occur.
- High (3) causes two or more of the above to occur.

Consequences of Introduction to California for *Coleosporium plumeriae:* Low

Add up the total score and include it here. **8**
-Low = 5-8 points
-Medium = 9-12 points
-High = 13-15 points

6) **Post Entry Distribution and Survey Information**: Evaluate the known distribution in California. Only official records identified by a taxonomic expert and supported by voucher specimens deposited in natural history collections should be considered. Pest incursions that have been eradicated, are under eradication, or have been delimited with no further detections should not be included.

Evaluation is 'medium'. There have been detections in commercial nurseries and in landscapes in multiple counties, and it is assumed that it is moving among hobbyists and in the nursery trade.

Score: -2
-Not established (0) Pest never detected in California or known only from incursions.
-Low (-1) Pest has a localized distribution in California or is established in one suitable climate/host area (region).

-Medium (-2) Pest is widespread in California but not fully established in the endangered area, or pest established in two contiguous suitable climate/host areas.
-High (-3) Pest has fully established in the endangered area, or pest is reported in more than two contiguous or non-contiguous suitable climate/host areas.

7) **The final score is** the consequences of introduction score minus the post entry distribution and survey information score: (Score)

Final Score: *Score of Consequences of Introduction – Score of Post Entry Distribution and Survey Information* **= 6**

Uncertainty: None

Conclusion and Rating Justification:

Based on the evidence provided above the proposed rating for *Coleosporium plumeriae* is C.

References:

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Responsible Party:

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*Comment Period: 11/03/2020 through 12/18/2020

*NOTE:

You must be registered and logged in to post a comment. If you have registered and have not received the registration confirmation, please contact us at permits[@]cdfa.ca.gov.

Comment Format:

- Comments should refer to the appropriate California Pest Rating Proposal Form subsection(s) being commented on, as shown below.

  Example Comment:

  Consequences of Introduction: 1. Climate/Host Interaction: [Your comment that relates to "Climate/Host Interaction" here.]

- Posted comments will not be able to be viewed immediately.
- Comments may not be posted if they:

  Contain inappropriate language which is not germane to the pest rating proposal;

  Contains defamatory, false, inaccurate, abusive, obscene, pornographic, sexually oriented, threatening, racially offensive, discriminatory or illegal material;

  Violates agency regulations prohibiting sexual harassment or other forms of discrimination;

  Violates agency regulations prohibiting workplace violence, including threats.

- Comments may be edited prior to posting to ensure they are entirely germane.
- Posted comments shall be those which have been approved in content and posted to the website to be viewed, not just submitted.

Proposed Pest Rating: C